Urban and Industrial Pollution Programs

Russia Case Study

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I. INTRODUCTION

Since the official dissolution of the Soviet Union in 1991, Russia has moved forward to make the difficult transition to open markets and more democratic institutions. The journey toward a complete restructuring of the Russian economy and an adoption of wide-ranging political reforms has been perilous. Political instability continues, crime and corruption have become more widespread, and economic conditions show little sign of improving quickly. Efforts to privatize state-held industries, initially seen as wildly successful, have now met with resistance, and full citizen involvement in government is far from complete.

The 1998 *ruble* devaluation was a severe blow to the Russian economy which is only just now showing some modest recovery. More recent events in late 2000 and early 2001 about freedom of the media, use of restrictive measures against some ethnic minorities, and a growing "recentralization" of power in Moscow under its new president encourage cynicism in the West about the fate of Russian democracy. Yet, despite all these setbacks, few experts disagree that over the course of the past 10 years Russia has become more open and more democratic.

What experts also agree upon is that the environment suffered under communism. Most called it a catastrophe. Environmental protection simply did not exist under communism or was a low priority during the Soviet era. Industrial growth in the former Soviet Union was almost always at the expense of clean air and drinkable water. Toxic spills were frequent, environmental laws unenforced, pollution fines set low, and graft and corruption common. As a result, in many large industrial cities such as Volgograd, Novokuznetsk, and Nizhnii Tagil, air quality was poor and air pollution–related diseases high. The Volga River, Russia's largest, is still severely polluted by industrial waste, sewerage, pesticides, and fertilizers. Many other Russian rivers such as the Don, Kama, Kuban, and Oka also suffered a similarly dismal fate. High levels of radioactivity in the Tomsk and Romashka Rivers, from a Siberian chemical complex in Seversk, have been reported in the national press as recently as November 2000.

Yet, today there is more hope in Russia than ever before regarding the environment. Citizens are beginning to demand better air and water. Russia is now a signatory to many key international environmental agreements. Dedicated environmental professionals armed with practical solutions can be found everywhere. And, Russia is exceedingly rich in natural resources. It has the world's largest natural gas reserves, the second-largest coal reserves, and the eighth-largest oil reserves. In addition, the largest-standing forest in the world lies in the Russian Far East.

For the environment, the emerging market economy in Russia has been a mixed blessing by most accounts. Many of the worst polluting factories have gone bankrupt or operate at only 50 to 60 percent capacity. Many are unable to compete in the open market, heavily reliant on former state subsidizes, using decades-old technologies, badly managed, or greatly undercapitalized. At the same time, democratic reforms have handed regional and local governments the responsibility of cleaning up long standing urban and industrial pollution but without the money needed to help these enterprises upgrade, the authority to enact effective pollution prevention laws and regulations, nor the ability to collect fines from local polluting enterprises.

In 1992, in response to the Gore–Chernomirdin Agreement[1] to provide environmental technology transfer and financial assistance to the newly independent states of the former Soviet Union, the U.S. Agency for International Development (USAID) launched its Environmental Policy and Technology (EPT) Project to help improve the environment. The Russian EPT components consisted of several activities including the Moscow Water Quality (MWQ) Project and the Russian Air Management Program (RAMP)—both implemented by the U.S. Environmental Protection Agency (USEPA). MWQ and RAMP are the main focus of this impact evaluation. In addition, several site visits were made to USAID's ongoing Replication of Lessons Learned (ROLL) Project, designed to replicate and expand EPT's best efforts. In October 2000, a four-person CDIE–led team went to Russia to assess the impact and effectiveness of EPT's urban and industrial pollution programs.

[1] Initially, this agreement established a bilateral commission to overcome energy sector trade barriers but now includes a much wider focus including business development, space cooperation, science and technology, health, and defense.

II. BACKGROUND

A. Project Overview

USAID's EPT Project was originally designed to bolster political and economic support for Russia.[2] This was achieved by laying the groundwork for Russians to solve long-standing and pernicious environmental pollution and natural resource depletion problems. Air, water, and land in most larger industrial cities were severely polluted, and valuable natural resource extraction—like logging—was either indiscriminate or proceeding at an unsustainable pace. These problems, in turn, were placing both immediate and more long-term constraints on Russia's transition to democracy. They undermined the government's ability to improve the health of its citizens, to provide more market-based growth opportunities, and to engage its citizens more fully in democratic activities such as environmental decision-making and public policy debate.

Continued weak stewardship of Russia's environment could create more costly health and financial burdens for the country and thereby undercut the U.S. government's then fast-paced political and economic support programs. EPT was designed to complement other "first-wave" support to Russia like that from the World Bank[3] and other donors, so timing was always critical. It was clear from project inception[4] that EPT was to show tangible results as soon as possible. Quick action on the ground was imperative. USAID was not unmindful of larger worldwide environmental concerns—like global warming, nuclear waste disposal, and pollution of international waters—that could be lessened from Russian environmental improvements under EPT as well.

EPT was launched in 1992. Many of its subprojects were not yet fully developed however, when EPT was initially authorized[5] and funded. Actual subproject specifics would come somewhat later in the form of individual activity work plans. EPT's activities, to varying degrees, were designed to meet one or more of the following five objectives:

1. Quantify the environmental impacts of known major pollution
2. Identify process and control technologies to reduce pollution
3. Build local environmental management infrastructure
4. Develop environmental regulations
5. Enhance governmental/private capacity for compliance and enforcement

Eight EPT subprojects took shape over the following few years[6]. Three of those were

[2] EPT's focus was broader than Russia. This CDIE country case study will focus specifically on Russian EPT activities.

[3] EPT was originally planned jointly with the World Bank, but the Bank later withdrew from the partnership.

[4] USAID Environmental Policy and Technology (EPT) Project Paper, p.4, 1992.

[5] Under the Freedom Support Act of 1992.

[6] Three additional USAID environmental support activities are worth noting. First, under a 1993 cooperative agreement to a U.S.–based university, USAID supported efforts to identify and analyze critical environmental policy issues, transfer U.S.–based applied research and policy skills to Russian professionals, and otherwise strengthen

led by USEPA (Moscow Water Quality, Russian Air Management Program in Volgograd, and Industrial Environmental Management in Nizhnii Tagil). They focused mainly on reducing industrial pollution including point source water and air pollution discharges. Three additional projects (Novokuznetsk Multiple Pollution Sources Management, Sustainable Natural Resource Management in the Russian Far East, and Lake Baikal Sustainable Development Practices) were implemented using more traditional means with U.S. and host-country contractors and nongovernmental organizations (NGOs).

Moscow Water Quality and the Russian Air Management Project in Volgograd were selected for study for three main reasons. First, their focus was consistent with the EPT project mandate that interventions in Russia be "...concentrated on environmental quality problems associated with urban and industrial pollution" and because EPT implementers always envisioned a very strong USEPA partnership[7]. Second, the goals of these two EPT subprojects are consistent with CDIE's ongoing Industrial and Urban Pollution Impact Series to develop Agencywide lessons learned[8]. Third, studying these two EPT subprojects may allow USAID to have a better understanding of project implementation success by another U.S. government agency with demonstrated environmental expertise[9]. Visits to selected sites of USAID's Replication of Lessons Learned (ROLL) Project[10], launched in Russia in 1996, logically follows in that EPT focused for the most part on having immediate and tangible environmental impacts to help strengthen U.S. political and financial support to Russia. Sustainability and replication were important but sometimes took a back seat under EPT. ROLL in contrast was designed to replicate and spread the best of EPT's pilot and demonstration findings making it a natural reference point for the CDIE team to understand the full extent of EPT's impact.

B. Russian Context

Russia, known officially as the Russian Federation, is approximately twice the size of the United States. This makes Russia the largest country in the world in terms of land area. It consists of 21 semi-autonomous republics (like Ingushetiya) with the rest of the country divided into 49 regions or *oblasts* and other territories. European Russia contains roughly two-thirds of all republics and *oblasts*. The other one-third of the republics and *oblasts* lie east of the Ural

environmental policy analysis and decision-making to support economic restructuring. Second, another USEPA–led activity under EPT was the establishment of a low-level liquid radiation waste facility at Murmansk. Third, USAID launched the Russia Energy and Environmental Commodity Import Program—commonly called CIP—also in 1993 to provide U.S. equipment to help improve energy efficiency and enhance environmental quality. CIP is discussed in Annex B.

7 USAID Environmental Policy and Technology (EPT) Project Paper, 1992.

8 The Russia Case Study is one of five conducted by USAID's Center for Development Information and Evaluation (CDIE) as part of its latest Urban and Industrial Pollution Impact Series. Other countries are the Philippines, Czech Republic, Chile, and India.

9 Another added benefit to studying MWQ and RAMP was that interviews with USAID/Washington staff revealed that they had little information from EPA on these two projects.

10 CDIE impact studies are designed to assess more long-term USAID development assistance impacts so ongoing projects like ROLL are rarely included since they do not allow for a "fair test" of sustainability or replication. On the other hand, not looking at some aspects of ROLL was deemed a missed opportunity by the Team.

Mountains. The sheer vastness of Russia makes most USAID assistance lean more towards demonstration projects in selected sites rather than widespread implementation in every *oblast*. Of course, there are exceptions like ROLL which has achieved very broad coverage throughout Russia.

Unlike the United States where federal environmental laws mostly predominate, Russia has often had two or more sets of competing laws. Laws and regulations governing the environment (and most all other sectors) are generally of two sources—federal and regional. More problematic, these laws are not always consistent. In fact, a recent study by the Federal Justice Ministry estimates that some 25–35 percent of regional legislation does not conform to Russian federal law. In any event, a number of government agencies are responsible for environmental protection in Russia.

Until a recent reorganization, the State Committee for Environmental Protection (SCEP) represented the highest-level federal executive body responsible for implementing government environmental policy including the issuance of licenses for pollution emission and discharge, the setting of standards or norms for emissions, and the levy of administrative fines for pollution violations. At the next level is an *oblast* committee for environmental protection whose responsibilities include implementing programs for land preservation and utilization, forest and park preservation, regional environmental protection, special ecological evaluations, and other environmental preservation activities. Lastly is a regional or local committee for environmental protection whose functions are to prohibit any activities causing harm to the local environment. For example, they can suspend construction or use of any facility that violates environmental laws and can grant use-rights for any natural resource in their jurisdiction.

Particularly relevant to this study are the local environmental funds which collect all air and water pollution fines. It is also important to note that many of the activities performed at one level may also be carried out by another level of government and that environmental protection laws can be promulgated at all three levels by legislative and executive bodies (federal level), by citizens (*oblast* level), and by local governmental bodies (local level).

C. Environmental Policy and Technology (EPT) Project

C-1. Overall EPT Project Specifics

The Environmental Policy and Technology (EPT) project was awarded in 1993 under several funding mechanisms originally totaling approximately US$35 million and later reached US$128 million. Of the original $35 million, approximately $11 million initially went to USEPA[11], $9.5 million to a U.S.–based consulting firm, and the remainder to cooperative agreements and other procurements. USEPA's work in Russia officially began in spring 1994 with the Moscow Water Quality subproject and in September 1993 with the RAMP subproject.

[11] $8 million under an Interagency Agreement and $2 million via a Participating Agency Service Agreement (PASA) with USEPA. It is important to note that the salaries of all USEPA staff were paid directly by that agency, not USAID, which only covered travel, logistical support, and limited commodity purchases. USEPA estimates its staff salaries, fully loaded, to be approximately $1.2 million.

C-2. Moscow Water Quality (MWQ): EPT Subproject

MWQ sought to improve Moscow drinking water quality and reduce health risks by introducing new approaches to upgrade the planning and management of wastewater treatment facilities (WWTF) and industrial enterprises (IE) and to curb agricultural runoff that influences water supplies flowing into the Moscow *oblast*. The MWQ subproject has two separate components. The first focused on improving the quality of WWTF and IE discharges upstream from Moscow in the cities of Tver (Tver *oblast*), Gagarin (Smolensk *oblast*), and Dimitrov (Moscow *oblast*). The second MWQ component sought to improve the small watershed management practices in the Istra District (located just west of the capital) in the Moscow River basin. The Istra District component was concerned with curbing non-point-source runoff from farms and two large agricultural enterprises and introducing watershed-based planning and education into local government programs. These were meant to serve as pilot efforts which could be considered for wider adoption by the Russian Federation, rather than solve site-specific health or environmental problems.

C-3. MWQ Component I: WWTF and IE Water Discharge[12]

This component had two specific objectives. The first was to improve operations and maintenance at targeted municipal wastewater treatment facilities (WWTFs) to decrease pollution loadings and consisted of two tasks:

(i) WWTF technical assistance: Perform an Operation Maintenance Evaluation (OME) assessment[13], and

(ii) WWTF training: Bring Russian wastewater treatment specialists to the United States to observe OME procedures and receive classroom/lecture training and equipment[14] and maintenance training.

The second objective of Component I was to improve the flow of IE discharges to WWTFs (so-called "pretreatment programs") and consisted of two similar

[12] The WWTF and IE work was managed by staff from the Office of Ground Water and Drinking Water at USEPA's Washington headquarters and from USEPA Region 5. OMEs were conducted by the Minnesota Pollution Control Agency (MPCA). They also managed the WWTF training and the professional exchange program. IE audits were conducted under a separate contract to a major U.S. engineering and consulting company.

[13] An Operation Maintenance Evaluation (OME) is a systematic assessment to identify all the factors (administration, finance, maintenance, facility design, operations, staffing, etc.) which limit wastewater treatment facility performance. OMEs are used to upgrade overall performance by ranking individual factors using a checklist showing what factor can have a major (A), minimum (B), and only minor (C) performance effect. With the check list in hand, evaluators and treatment operators can array factors along a continuum from no-cost, to low-cost, through high-cost improvements. OMEs can also be applied to a piece of equipment or an entire WWTF and is commonly used in the United States and EU countries.

[14] This equipment was provided under the MPCA Project and consists of flow meters, automatic samplers, vacuum pumps, dissolved oxygen meters (to measure BODs), sludge judges, assorted laboratory equipment (scales, colorimeters, pipettes, etc.), chemicals, and spare parts. Some of the flow meters were new, others used but rehabilitated. This equipment was procured separately from the CIP Program.

Component I tasks but focused on enterprises instead:

(i) IE technical assistance: Conduct an enterprise environmental audit focused primarily on reducing wastewater discharges before entering the municipal wastewater system, and

(ii) IE training: Bring Russian IE treatment specialists to the United States to observe industrial wastewater treatment and receive classroom/lecture training.

C-4. MWQ Component II: Small Watershed Management[15]

This subcomponent sought to control agricultural and other related waste from contaminating small tributaries, which eventually led into the Moscow water supply. The idea was to introduce the latest low-cost technology and management practices at selected demonstration sites followed up by "open houses" and public information campaigns to spread the word. The Istra activity also included an in-country educational component directed at school children and teachers as well as a teacher exchange program—both designed to increase public awareness, facilitate replication to nearby basins, and support local regulations to improve the environment[16]. Like MWQ component I, the Istra District small watershed activity consisted of several tasks:

(i) Baseline surveys and data collection: Conduct general opinion polls, livestock enterprise feasibility studies, update an ecological database, and assess animal waste management procedures;

(ii) Animal technology and management demos: Conduct small farm, livestock, and riparian buffer zone demonstrations;

(iii) Public outreach and education: Conduct student education, teacher exchanges (Istra District and Ames, Iowa), strengthen local NGOs, and raise public awareness;

(iv) Water quality assessment: Assess water quality, monitor demonstration site point source pollution, and network with other monitoring sites; and

(v) Dissemination: Disseminate project findings in the Moscow–Oka Basin and to other watersheds by broad-based public information and education programs.

C-5. Russian Air Management Subproject: EPT Subproject

The Russian Air Management Program (RAMP) began in 1993 and focused on Volgograd, a large industrial city in the

[15] USEPA Region 7 staff through a cooperative agreement managed the small watershed work with the Center for Agriculture and Rural Development at Iowa University and local Russian project managers. The educational and teacher exchange program was managed by a U.S.–based, nonprofit NGO.

[16] Another watershed objective was the establishment of an Environmental Law Taskforce. It consisted of Russian and American environmental lawyers and other environmental professionals. The purpose of the Taskforce was to provide legal analysis, documentation, policy analysis, and recommendations supporting environmental laws and regulations and otherwise lend legal advice for MWQ and RAMP subprojects.

Volga Region. RAMP implementation was preceded by preliminary investigations and discussions between the U.S. Environmental Protection Agency's (USEPA) Office of Air Quality Planning and Standards (OAQPS), the U.S. Agency for International Development (USAID), and Russian counterparts—primarily in the now-replaced Russian Ministry of Environmental Protection and Natural Resources (MEPNR). As with the Moscow Water Quality subproject, USEPA covered the labor costs for its staff, and USAID covered all other associated costs. RAMP ended in 1999.

Volgograd was selected for the pilot project because of results from USEPA's prior "rapid assessment" and pollution prioritization of 20 Russian cities. Prioritization considered pollutants and emission levels, ambient air quality, and human health. At that time, Volgograd was ranked as the sixth most polluted city in Russia. There were also prior work and relationships in place between USEPA and the Volgograd Environmental Services Administration (VESA), MEPNR, and the World Bank (WB), which had originally intended to invest heavily in Volgograd's diverse industrial base[17].

The overall objective of RAMP was to develop and test a model air quality management (AQM) program[18], based primarily on training, technology transfer, and public awareness. It was assumed that the model program could later be modified as appropriate and integrated at the federal level into the Russian environmental regulatory framework. It was also assumed that it could later be replicated in other Russian cities having need or desire of a more responsive AQM program.

RAMP comprised nine major components that make up a traditional AQM program. These components represent the major tasks executed under RAMP, i.e.:

(i) Air quality monitoring – as special intensive studies using a high density sampler devices over a short period of time ("saturation study"), ongoing sampling and analysis, and data reporting. The purpose of such studies is to gain a better understanding of the relationship between specific sources of pollution and ambient air quality. This was accomplished with respect to sources around the Volgograd "Triangle." This consisted of the Red October Steel Mill, Volgograd Aluminum, and the Silica Brick Factory.

(ii) Source assessments – that ultimately focused on the major local industries (steel smelter and mill, aluminum smelting plant, and silica brick plant were selected) to identify "low cost" and "no cost" (LC/NC) measures for pollution prevention or—more appropriately—reduction. Detailed assessments were performed for nine other industries in the "Triangle." More intensive implementation was pursued at only three of those industries: Red October Steel Mill, Volgograd Aluminum Factory, and the Silica Brick Factory.

[17] WB withdrew from the RAMP subproject prior to initiation due to differences in opinion and approach with USAID and the inability to secure loan guarantees from the Russian government.
[18] The Air Quality Management (AQM) program was patterned after proven approaches to monitor and improve air quality in use in the United States and throughout Western Europe.

(iii) Emissions inventories/emission factors[19] – to improve the ease of performance and accuracy of estimating actual rates of emission of air pollutants, reduce the cost of making such estimates and making the Volgograd emissions inventory more complete and correct, as required for an effective AQM. The approach tested in Volgograd, both as a means of improving the quality and completeness of the emissions inventory and as a means of providing the required information at a much lower cost. Actual source testing, which is quite expensive, may not be required on an annual basis. This is particularly important to smaller and financially stressed organizations.

(iv) Emissions testing – primarily in support of the development of emission factors that more accurately represent actual emissions. Emissions testing was conducted on several sources and source types in Volgograd. Results were used to improve the inventory and emission factors and provide data that was subsequently used to fine-tune boilers and improve combustion efficiency. This could result in lower fuel use rates and lower air pollutant emissions per unit heat output.

(v) Human health and risk assessment – relying in part on an inventory and prioritization of over 1,000 regulated air pollutants (toxic and hazardous pollutants) present in and around Volgograd. This approach could be used to prioritize the order in which pollutants would be addressed and the order in which industries emitting those pollutants would be evaluated. In Volgograd, particulate matter (PM) was determined to be the most harmful pollutant with respect to human health effects.

(vi) Compliance and enforcement – primarily as training on methods of source inspection for regulatory agency staff and provision of sampling and analysis technology—including USEPA Method 9 [“Visible Emissions” (VE)[20]]—and strategies for effective enforcement.

(vii) Public participation – through the collaboration of government, industrial, and nongovernmental organizations (NGOs) in the presentation of seminars, conferences, training, and materials distributed by the news media and other organizations.

(viii) Legal framework – primarily as a separate but associated effort by USAID and the now-terminated Harvard Institute for International Development (HIID), by which legal issues presented by existing and proposed regulatory law, and as might be relevant to the Volgograd RAMP project, were discussed with counterparts in the Volgograd

[19] Factors, based on source testing studies, can be used to estimate actual emissions based on known process rates (e.g., 1.2 pounds of sulfur dioxide emitted for every million BTUs of thermal output).

[20] USEPA Reference Method 9 uses visual emissions observations as a compliance method.

Committee on Environment, USAID, and USEPA.[21]

(ix) Training – primarily with and through the Volgograd Center for Environmental Training (CET), which was established expressly for the purpose of coordination and provision of environmental training in Volgograd, and as a vehicle for dissemination of "lessons learned" during RAMP.

C-6. Replication of Lessons Learned (ROLL) Project

Project Specifics

The Replications of Lesson Learned (ROLL) Project[22] was awarded in August 1996 under a four-year cooperative agreement to a U.S.–based nonprofit, nongovernmental organization (NGO) headquartered in Vermont. ROLL was designed to replicate and spread the best of EPT's pilot and demonstration findings. The initial agreement was recently extended six months until February 2001 for a total cost of $11.5 million over 4.5 years. Work began in Russia in late 1996, and the ROLL project is ongoing. The CDIE team visited several ROLL grantee sites to gain an understanding of the work currently underway and which lessons learned under EPT were being replicated.

[21] As work in legal and regulatory issues was conducted separately by HIID from the USEPA–implemented RAMP component of EPT, the CDIE team did not assess this particular element of RAMP. Rather, the team focused its efforts on those components of RAMP implemented by USEPA.

[22] In 2000, USAID awarded a $12 million, follow-on contract to the original ROLL Project called ROLL 2000. Throughout this report the use of the ROLL will refer to the original ROLL Project unless otherwise indicated.

III. PROGRAM ELEMENTS

Environmental pollution abatement and management programs typically use one or more of the following five program elements: economic policy reform, environmental regulations and standards, institution building, education and awareness campaigns, and technological change. These elements almost always come into play but are not so easily disentangled. For example, environmental management (institutions) may be weak because enforcement (regulation) is weak. In turn, enforcement could be weak because of a lack of political will (institutions) or a lack of equipment (technology). The lack of equipment could be the result of a weak organization devoting relatively fewer resources to important areas or because financing is insufficient to cover costs. The important point is that most environmental activities fall into one or more of these five program elements and that most solutions will involve working in more than one of these program elements.

These program elements, in effect, are the underlying variables that form a “working hypothesis” about how to curb urban and industrial pollution in developing and transitioning countries. There may be other variables and other schema of course. Nevertheless, these five program elements have been successfully used by USAID to examine countries in the current Agency environmental series—the Philippines, Chile, India, and the Czech Republic. At the very minimum, the elements have proved to be a very useful heuristic device to catalogue the range of development assistance interventions. The elements should not be confused, however, with criteria against which to judge each activity. The Russia case study, like those of the four other countries, is designed to inform the development of new USAID program and activities

A. Economic Policy Reform

Economic policy can be an important contributor to sound environmental management. Through the proper pricing of resources and the establishment of incentives and penalties, economic policy can realign decision-making to more properly take into account the externalities associated with environmental and social costs. Neither of the EPT subprojects nor ROLL were designed to significantly help reform economic policy. Nevertheless, these issues are discussed below so that the reader can see how they either support or impinge on subproject implementation and results.

A-1. Pricing

Russia has historically undervalued inputs in the production process either through a system which did not recognize the role of markets (central planning) or one that subsidized key inputs such as oil, coal, gas, or water. Either approach can increase the demand for inputs in production and increase the environmental damage associated with their oversupply and use. Likewise, failure to use markets or to subsidize inputs has had a similar effect on consumption. For example, subsidization has kept end-use energy prices artificially low encouraging excessive energy use.

In a command economy where profit is not considered important and production levels are officially set, prices do not properly influence market decisions or exert much pressure to improve resource efficiency.

Often, input prices including energy are set artificially low leading to excessive consumption per unit of output. In addition to the broader resource allocation issues, this situation results in high levels of waste and pollution.

Russian energy prices are still below "market" levels, and as a result pollution and natural resource degradation in Russia is greater than it would be otherwise. Russia is the world's third-largest energy consumer. When this is viewed as energy consumption per $1,000 of gross domestic product (GDP), Russia's inefficiency is clear. For example, in 1997 Russia consumed 61 thousand BTUs of energy for $1,000 of GDP, the highest rate in the world. This compares to China at 41.4 thousand, India at 31 thousand, and the United States at 11.6 thousand BTUs per $1,000 of GDP.

Material and energy input pricing and product outputs were not considered under RAMP or MWQ. Determination of whether fair-market pricing of process inputs might have presented opportunities to increase costs of such inputs, which in turn might have encouraged recovery of lost raw materials and intermediate products and a reduction of rejection rates of final products, was not considered. Whether subsidies on output prices adversely affected efficiency thereby contributing to higher emission rates might also have revealed opportunities to reduce emissions by forcing higher recovery rates of lost raw materials and intermediate or final products.

A-2. Market-Based Instruments

Russia has long had a system of pollution charges, fines, and user fees. Pollution charges are imposed on emissions or effluents up to the standards allowed by law. Fines are imposed at the rate of five times the pollution charge for emissions or effluents in excess of standards. These instruments, which raised 1.3 trillion *rubles* in 1996 and 1997[23], have not proved to be an effective incentive to curtail pollution for two important reasons. First, the rates are quite low. Second, compliance and enforcement are weak. Cambridge International Forecasts state that of the 250,000 reported violations of environmental standards, 40 percent go "unpunished or unrectified." One of the major factors behind both low compliance and weak enforcement in the recent past has been the poor condition of the economy; many companies can not afford to pay, and local authorities are hesitant to place further burdens on nearby firms when the economy is stagnant and jobs are in short supply.

Fees and fines for water pollution are collected by the local ecological fund[24]. Ten percent is transferred to the federal government, 30 percent to the Regional Environmental Committee, and 60 percent remains with the Ecological Fund. Of this remaining 60 percent, 80 percent will go to wastewater treatment (or about 43 *rubles* out of each 100 collected), and 20 percent will go for public education and awareness[25].

Air pollution fees and fines are also collected by the local ecological fund and

[23] Team Canada 1999 Country Market Report on the Russia Environmental Sector.

[24] There is some confusion about this due to the reorganization of the former State Committee for Environmental Protection and its absorption into the State Committee on Natural Resources. The precise details about allocation have yet to be worked out. Anticipated changes however are not expected to significantly alter the distribution of collections.

[25] This is an example from the Dmitrov Ecological Fund; other funds may have different allocation priorities.

are used for a variety of projects involving public education, research, support for public environmental organizations, and rural water supply. Market-based instruments in the form of increased emission fees and fines were discussed in RAMP and addressed in the subproject's Legal Framework component, but the current system of grossly undervaluing environmental impacts is firmly entrenched in the current regulatory structure. Ongoing poor financial performance in most industrial sectors and particularly in older facilities and the need to protect indigenous industries from lower-priced imports preclude aggressive use of market-based instruments at this time.

Russia allows Vodocanals (i.e., water authorities) to charge user fees for water treatment services. The fees are proposed by the Vodocanal but determined by Communal Services and the Administration. The fees are insufficient for full cost recovery, and assuming that social cost is at least equal to the cost of treatment this means that the "demand for pollution"[26] is greater than it would be if the full cost of treatment were passed on to dischargers.

A-3. Financing

Restructuring of government environmental institutions, the economic downturn, privatization, and other factors make adequate financing of environmental measures one of the most important obstacles facing Russia today. Municipalities are heavily dependent upon federal outlays, and most do not have sufficient resources to provide the level of service needed. There is not an adequate market for municipal bonds or lending as has been the case in many other USAID–assisted countries. Similarly, Russian industry faces many of the typical finance constraints of developing countries. In addition, the current economic and political situation in Russia does not favor new investments, and available cashflow is typically used to finance ongoing operations—not new investment.

Ecological funds exist to provide financing to government environmental agencies and for addressing environmental problems. However, their capitalization is small relative to the problems, and much of their resources go to salary and operating expenses. They depend on fines and fees, both of which are set at unrealistically low levels. Fines and fees are not sufficient to serve as major incentive for appropriate environmental behavior.

It can be said that perhaps RAMP and MWQ may have missed an opportunity in that project financing was either not considered or explicitly built into the project design. To be sure, several of the assistance activities may have lowered costs for participants, but actually obtaining financing to continue or expand was virtually impossible in Russia at the time.

During the course of the evaluation, the lack of financing was cited as one of the primary obstacles to implementing otherwise desirable programs or technologies. Assistance in identifying sources of grants and financing and assistance in the development of high-quality applications for loans and grants would likely have resulted in better implementation.

[26] The "demand for pollution" refers to the demand for environment services in the form of water, air, or land to deposit the unwanted by-products of economic activities.

This was true in all cases except the Volgograd Aluminum Smelter, which is financially successful. The smelter, now under full or partial foreign ownership, implemented almost all of the recommended measures. This was done after multiple meetings with RAMP staff and the intervention of VESA personnel.

B. Government Regulation and Standards

Environmental laws, standards, and regulations—and the government's capacity and willingness to enforce them—are the keys to protecting and improving environmental quality. Russia has some of the most extensive and stringent emission standards in the world and a complex bureaucracy to monitor and enforce compliance. Perhaps the situation can be summarized as follows: "Russia has some of the most stringent environmental standards in the world, and some of the laxest enforcement." For example, the law stipulates that pollution and emission permits are valid for a period of two years only. In practice, permits are often in place for five years or longer[27]. Emission standards are national in scope with no changes allowed for local conditions. This rigid approach often results in standards that are more or less stringent than are necessary for local conditions and translates into either more protection (and cost) than is necessary or not enough.

The most important issues are the complexity of laws and the inconsistency of laws across jurisdictions. Both the complexity and inconsistency reduce effective compliance, drain resources, and undermine the political will for law enforcement. The Moscow Water Quality (MWQ) subproject recognized the importance of introducing more rational environmental laws and regulations. Project designers felt that given the fast-changing circumstances of Russian politics, it was better set aside. There were a few exceptions however. For example, the project attempted to provide Regional Environmental Committee (REC) members with an understanding of temporary permitting. Also, for more general environmental legal issues, a separate Legal Taskforce was set up by USEPA.

RECs are responsible for issuing permits for construction and operation, fee collection, and fine enforcement. The MWQ subproject, for example, introduced new concepts of temporary permitting wherein a discharger exceeding standards would not be fined provided that (a) the plant developed and implemented a pollution mitigation plan that was accepted by the REC and (b) that progress was made toward reaching the legal emission standard. In such cases, the plant would then be issued a "temporary permit" which set a new schedule with graduated effluent standards leading toward the legal limit.

Monitoring dischargers is complex, and sound pollution monitoring requires equipment. Government laboratories had qualified staff, but they often lacked basic equipment and could not adequately monitor industry[28]. In water monitoring, for example, plant officials used a "grab" or one-time

[27] Based on conversations with Regional Environment Committee (REC) staff.

[28] Key monitoring equipment was known and available in Russia. Those in charge either did not see the overwhelming benefit of this equipment, did not have the funds to purchase it, or both.

method for sampling. This allowed factories to discharge beyond the limits when continuous sampling was not taking place. It also prevented control authorities from developing a profile of the industry. The MWQ subproject provided equipment to conduct continuous sampling and thereby reduced this abuse.

RAMP addressed the issue of Russia's air pollution regulations and standards through interventions in the areas of compliance and inspection. While Russia has some of the strongest emissions standards in the world, deficiencies in permitting and the enforcement process negate the positive results that could be achieved through the existing regulatory system. Thus, RAMP worked with stakeholders in Volgograd to strengthen the existing system and used interventions that had immediate and practical benefits. A prime example of this would be the introduction of USEPA Method 9 "Visible Emissions" testing as an enforceable standard. Programming under RAMP also sought to rationalize the existing emission fee system and strengthen Volgograd's inspections program.

C. Institution Building

Effective management of Russia's environment requires strong institutions that work in close harmony. Strong institutions require political commitment, effective enabling rules and regulations, trained and motivated staff, and sufficient financial resources. Moreover, given the conditions in Russia facing both environment users and those charged with managing it, it is important that institutions adopt a proactive strategy that emphasizes collaboration over confrontation.

The institutions charged with managing Russia's environment face many challenges. They are often underfunded and therefore cannot properly staff, train, equip, and manage their environmental tasks. This underfunding typically results from user charges which are too low and from inadequate federal budget allocations (and reallocations) for environmental investments[29]. In the past, these outlays have been less than one percent of the entire federal budget allocated to any kind of environmental infrastructure[30]. These problems notwithstanding, the staff interviewed were motivated and hard working.

For the WWTF component of the MWQ, the principal problems requiring immediate environmental improvement were the direct result of too little equipment and the lack of familiarity with modern methods in testing, maintenance, and repair of facilities and industrial treatment methods[31]. This WWTF component sought to address these problems by providing training and a modest amount of testing equipment. Additional equipment was donated. The WWTF component also provided a greater sense of vision or purpose for the facility and a new approach to problem solving and cooperation.

[29] Historically, capital funds for water treatment plants have come from federal allocations. This is changing as there now appears to be inter-*oblast* transfers recognizing water basin supply relationships. For example, the Moscow *oblast* is providing funding to Gargarin Vodocanal for water treatment in recognition that the principal beneficiaries of this treatment are the citizens of Moscow. Additionally, municipalities are seeking donor funding for treatment facilities and equipment.

[30] Team Canada 1999 Country Market Report on the Russia Environmental Sector.

[31] The topic of modern methods is discussed below under the "Technological Change" subheading.

For the Istra component, the principal problems were a lack of knowledge in appropriate animal waste management techniques, a general public that did not understand the animal waste problem or how to attack it, and local authorities that lacked the political will to carryout recommendations. Another problem for Istra was that the institutions charged with management were at cross purposes, divided, and lacking in sound data collection, measurement, and analysis techniques. In short, the solution was a "design of the Istra project based on the watershed management approach as developed and practiced in the United States."[32] What project designers (a joint U.S. and Russian team) may have failed to fully appreciate was that the U.S. model was developed over decades and framed by a U.S. industry and economy that were not undergoing dramatic change as in Russia.

Institution-building under RAMP was targeted primarily on the Center for Environmental Training (CET), Volgograd Environmental Services Administration (VESA), and several local NGOs. RAMP efforts resulted in the development of a much closer rapport and better communications between VESA and the NGOs, more integration of NGOs into the environmental management process at an earlier stage, and a better functioning CET. CET continues to function with VESA funding and revenues generated primarily from environmental training courses.

C-1. Training

While plant staff in municipal areas were highly skilled and educated, this was not the case in rural areas where pollution loads are predominantly household sewage and agricultural wastes. Water treatment staff had no formal work-related training or education. They were not able to make even the simplest of repairs. Project-provided funds under the WWTF component allowed rural staff to make minor repairs and help develop primary treatment approaches where none existed.

Istra also trained staff. For example, farmers lacked training on basic methods of sound environmental animal waste management. Istra imparted this knowledge through on-the-job training and demonstrations. Operational staff at municipal facilities and industry were educated and trained on existing Russian methods, but most of the other workers lacked formal training in wastewater practices and operations.

C-2. Equipment

Most of the institutions also lacked even the simplest of equipment that would have significantly increased their ability to improve treatment efficiency and improve the quality of the effluent. For example, basic equipment such as flow meters, automatic samplers, dissolved oxygen meters, sludge judges, or colorimeters were lacking. In some cases, facilities lacked even the simplest of equipment such as pipets, and most labs lacked spare parts and reagents for water quality testing. The same deficiencies in basic equipment existed for farmers and livestock enterprises.

D. Education and Awareness

When properly conceptualized and provided, public education and awareness can broaden the impact of a technical assistance program. Public information and

[32] Istra Final Report, USEPA.

outreach programs involve more people in support of community-related activities thus strengthening local government capability. The Istra component of the MWQ project contributed heavily in this area, educating school children, holding public events, and reaching the masses through newspaper and radio. These are important approaches but usually take a long time to generate measurable environmental benefits.

The Istra component began with education. This accounted for about one-fifth of the budget, but as success appeared less achievable in other areas, activities were shifted more and more toward education. By the project's end, approximately one-third of the entire budget was allocated to education. A curriculum was developed along with instructional materials, teachers were trained, and class work was begun at seven schools. This singular education component of Istra has become a great success.

Education and awareness efforts under the RAMP project were quite successful in increasing public knowledge of environmental matters and in training regulatory, institutional, and NGO staff. This was due primarily to the proactive efforts of VESA and the city administration, CET, and the Volgograd Citizens Environmental Task Force (VCETF) with support and assistance from USEPA and USAID.

E. Technological Change

Introducing new technologies and techniques can reduce costs and/or broaden environmental and economic impact. In MWQ, geographic information systems (GIS) were introduced as were new procedures in animal waste handling, storage, and use under the Istra component. Waste minimization, by-product recovery, recycling, and pollution prevention complement abatement and treatment in efforts to improve environmental quality based on sound economic principles. Likewise, improved techniques to identify opportunities to improve performance at existing wastewater treatment plants can significantly improve environmental quality. Technology change made a significant contribution to improved environmental quality through the introduction of the Operation Management Evaluation (OME) technique. An OME assesses all potential limiting factors of wastewater treatment operations including "administration, finance, maintenance, facility design and operation."[33] The OME targeted no-cost/low-cost implementation options due to the financial constraints facing industry and government alike. It also made other recommendations to significantly improve treatment.

Technology introduced under RAMP was in the form of equipment, training, operations, and maintenance. It should be noted that more attention should be paid to what is appropriate in the host-country operating environment rather than what would be used if the environmental problems occurred in the United States. Determinations of what is appropriate should consider such things as initial cost (important to replications where the user must purchase), operating and maintenance costs, acceptability and approval for compliance and enforcement, and ability to function in the physical environment.

[33] The Minnesota Pollution Control Agency Final Report of Cooperative Agreement CX8224089-01, page 5.

Technical training in equipment use provided under RAMP included the operation of laboratory, ambient air, and air pollutant source sampling equipment. RAMP also provided training in visible emissions (VE), environmental audits, U.S. study tours (for familiarization with air quality management techniques), and the latest environmental management techniques.

Finally, equipment provided under RAMP—or through CIP in support of RAMP objectives—included over US$4 million in state-of-the-art analytic laboratory equipment (75 percent of total amount), ambient and source sampling equipment, a smoke generator for VE training and certification testing, and the prototype of the steel smelter “delta” [ceramic cover for electric arc furnaces (EAF)].

F. Summary of Program Elements

The table below presents a quick summary of the five program elements addressed by EPT subprojects.

Table I

	Moscow Water Quality		**RAMP**
Program Elements	WWTF	Istra	
Economic Policy	NO	NO	YES
Gov. Regulations and Standards	YES	NO	YES
Institution Building	YES	YES	YES
Education and Awareness	NO	YES	YES
Technology	YES	YES	YES

IV. IMPACT

Environmental programs are often designed with very different objectives. Yet these impacts can be put into four broad categories. Of course, other categories can be proposed, but these four have proved quite useful with USAID's current environmental country case studies.

Institutional Impacts revolve around the establishment and strengthening of institutions to design, evaluate, undertake, monitor, finance, and enforce environmental activities; ***Environmental Impacts*** help to improve air and water quality and/or the quantity of environmental resources (water ecosystems, ground water, biodiversity, endangered species, and terrestrial ecosystems) at the national and global level; ***Human Health Impacts*** are associated with disease prevention and health promotion—air pollution contributes to diseases such as lower respiratory infections, chronic bronchitis, as well as hospital admissions and premature mortality; and ***Economic Impacts*** include all impacts directly valued in the marketplace and incurred directly by project participants (financial impacts) and those borne by additional parties not captured in the financial analysis (e.g., social and health-related costs). The team's assessment of the overall project impact using these four dimensions follows.

A. Institutional Impacts

WWTF Component

The MWQ subproject had strong and important positive impacts on Russian institutions. The team found evidence that at all levels (RECs, Vodocanals, and individual wastewater treatment facilities in industry, municipalities, and rural areas) institutions were strengthened as a result of participating.

The subproject achieved this by:

1. Providing basic wastewater treatment training for day-to-day operations where lack of funds had precluded such essential training. Most of this training was provided in Russia either by those already trained in the United States, through local consultants, or through the strengthening of an existing training institution, the Smolensk Environmental Training Center[34].

2. Strengthening enforcement institutions (REC and laboratories) by providing them with tools and training so their results were not refuted by local industries. Prior to the subproject, the authorities did only routine or "grab" sampling at one point in time. Moreover, locally authorized laboratories were not well equipped or certified. Both the training and equipment received under MWQ allowed the labs to become fully certified and to monitor major polluters on a continuous basis. Industry and local government both reported that this monitoring actually reduced conflicts and provided for a more positive working partnership between authorities and industries.

3. Helping to change the way participants approached pollution management by showing them new tools (such as temporary permitting) and exposing them to new opportunities such as

[34] Subsequently received a ROLL grant.

multidisciplinary teams. The temporary permit was a novel concept in Russia, and seeing it in action in the United States while on training was invaluable. Two of the three *oblasts* visited indicated that following their study trips to the United States they had successfully implemented a permitting scheme. The results are impressive even if only anecdotal. For example, the Tver *oblast* REC issues about 1,000 permits per year of which 30 percent were temporary. Seventy-five percent of those that were issued temporary permits are reaching legal standards within the allotted time. This reduced compliance costs (no fines) and strengthened relationships between industry and environmental authorities. The authorities reported that the expertise they gained in the United States helped them work with industry to develop appropriate wastewater treatment schemes that meet temporary permit requirements.

Istra Component

The Istra pilot project had a positive, albeit minor, institutional impact. Istra worked with a number of government institutions directly in the course of fulfilling subproject objectives and providing training. National, regional, and local government institutions appear to have improved qualitatively. For example, the Istra school administration received training, curriculum development, and teaching materials which were put to good use. VodNIIinformproekt—the Water Design Institute—received training in Geographic Information Systems (GIS) and watershed management approaches. The Institute has successfully incorporated these concepts into the development of guidebooks and in their day-to-day work in watershed management. Many government institutions were involved in data collection under Istra. As a result, their collection and analysis capabilities were strengthened. Positive benefits of joint efforts in watershed management were in contrast to the Russian practice of separate and sometimes conflicting efforts.

RAMP

Impacts at the institutional level consisted of providing improved monitoring, compliance, and enforcement tools at the local regulatory agency level and development of a better-informed and more capable group of NGOs. RAMP also attempted to impact the regulatory approach at the federal level by introducing new types of sampling and analysis equipment, promoting the acceptance of such equipment, and introducing the concept of visible emissions (VE) as a regulatory compliance assurance tool.

Further development of the capabilities of VESA, CET, and local NGOs—and fostering of more effective communication and cooperation among all three—also improved each organization's capabilities, performance, and efficiencies.

B. Environmental Impacts

WWTP Component

Environmental impacts were the direct result of introducing new equipment and maintenance techniques under MWQ. At all municipal sites where equipment and training were provided, wastewater quality increased[35]. At these sites there had been no attempt to precisely determine how much was due to the equipment and how much was due to new methods. Additionally, compounding the measurement problem was the general decline in economic activity that altered wastewater composition and treatment volume over the project's life.

Changes at other facilities would have taken place only indirectly through training or use of new techniques. The team found that there was a general consensus among government officials that improvements had been made. The Smolensk Environmental Training Center received high praise, training 696 wastewater treatment operators during the period under study. The Center tracked water quality both before and after training. It found improvements at those facilities receiving training. However, they had not attempted to separate the improvements in water quality due to economic situation from improvements due to training.

Istra Component

Istra sought immediate environmental impact by building dams, manure lagoon retaining walls, and manure storage facilities; working with local livestock operations; demonstrating proper manure application; and providing the latest solid waste management techniques. Some of these activities occurred in multiple sites, others were focused on just one location. Istra successfully implemented much of what it set out to demonstrate, but the environmental impact of these interventions is modest owing to the relatively small size of some demonstrations, the decline in production activity at others, and the failure of some interventions to take firm hold—such as the planting of seedlings and sludge treatment. By all accounts, environmental impacts were negligible. Improvements were negligible because one demonstration project was stopped and the other facility abandoned owing to poor economic conditions and demonstration site insolvency.

RAMP

According to some sources, and reported in the RAMP Final Report[36], air pollutant impacts (particulate matter) were "assumed" to have been reduced from 8 to 12 percent. Further examination revealed that the majority of the reductions may have occurred as a result of reductions in fugitive emissions[37]—primarily road dust. Approximately 30 percent more reduction in emissions could have been realized through implementation of other measures recommended under RAMP based on interviews with plant operators and VESA staff. However, during and since RAMP, major economic downturns in Volgograd have resulted in significant reductions in output at the Red October Steel Mill and in the closure of the Silica Brick facility (though smaller, specialty operations at the Mill continue under various ownership—and in compliance with environmental regulations). The team was unable to directly verify the widely reported 8 to 12 percent reduction in pollution from RAMP.

[35] This increased quality is documented in USEPA final reports and in discussions and data reviews with the plant operators.

[36] RAMP implementers in Volgograd includes staff at VESA and CET.

[37] Defined as emissions from other than smoke stacks or vents, such as windblown dust, evaporative losses from an unenclosed area, etc.

Based on recent environmental data, Volgograd is now ranked as the twentieth most polluted Russian city, whereas at the outset of RAMP it was the sixth most polluted. However, it was stated by VESA officials that this is not due to RAMP interventions but rather the general downturn in industrial output. Whether RAMP had any lasting effect can only be determined once local industries increase outputs in response to economic conditions in Russia. Even then, it will be hard to prove.

It is now estimated that more than 50 percent of air pollution in Volgograd is from mobile sources not addressed by RAMP.

C. Human Health Impact

WWTF Component

It is difficult to measure health impacts in MWQ as project participants were not the immediate environmental beneficiaries of the project. Changes reflected in water quality from the municipal treatment plants and industries would be reflected over time in changes in Moscow's drinking water quality. It was beyond the scope of the project to assess this, and local authorities were very hesitant to link changes in their wastewater quality to downstream changes in Moscow's drinking water. MWQ never intended to measure health impacts. However, there is an implicit assumption that effluent standards are set with human health impact in mind and, therefore, meeting the standard is all that needs to be demonstrated.

Istra Component

There appears to be little demonstrated health impacts from project activities at this time. With the course of time, environmental education may have an impact on environmental quality and subsequently on human health, but present evidence is lacking.

RAMP

Pollutant exposures were to be measured and prioritized in order of severity and extent of health impacts under RAMP, and efforts were to be undertaken to reduce emissions in a prioritized manner. However, this did not happen. According to most VESA engineers interviewed, no change in human health conditions occurred as a result of RAMP. However, there may be future benefits. Impacts of RAMP on human health in Volgograd are uncertain, due primarily to four reasons:

- Industrial downturns at the Red October Steel Mill and Silica Brick Facility resulted in far greater reductions in emissions than those realized by control of fugitive emissions.
- Fugitive emissions of PM are typically larger than the respirable fraction (nominally PM-2.5).
- Estimates ranging from 900 to 2,666 excess deaths per year due to air pollutant exposures in a population of 1,000,000 appear to be based on the assumption that the entire mass of PM is at PM-10 or possibly PM-2.5, and this seems to be a gross overestimate.
- Antagonistic effects of vehicular and other pollutants were not considered.

In other words, production downturns, assumptions about the causative effects of respiratory illness, and the emergence of other pollution sources make health impact from RAMP indeterminable.

D. Economic Impacts

WWTF Component

There are many reasons why economic impact could not be determined under MWQ. For one, baseline data did not exist for some of the sites. In others, no attempt was made to disentangle the impact of the economic downturn at industrial enterprises versus that of improved water treatment *per se*. Thus, it was not possible to say how much of the improved water quality was due to reduced inflows from industry and how much was due to the project.

Istra Component

There was no measurable economic impact on project participants or society in general from Istra.

RAMP

Due to the low rates of emission fees and fines and a general lack of industrial process improvement, economic impacts—as measurable at the corporate "bottom line"—were either not determined or only minimal at best. It is difficult to determine or demonstrate that the "dirtier" industries were also the technically outdated industries most affected by competition from imports, higher production costs, and general effects of the economic downturn that continued for the duration of RAMP. The provision of goods and services in the environmental sector has also been fairly weak, so there has been little positive impact—except for aggressive and well-trained entrepreneurs who would likely have succeeded with or without RAMP.

The only clear case of positive economic impact appears to be the installation and operation of diesel oil (boiler fuel) emulsifiers[38] at the Red October Steel Mill (ROSM). This process of using waste fuel oil emulsification (WFOE) has dramatically reduced fuel consumption, emissions, and wastewater discharge from ROSM; is sustainable; and has been widely replicated based on team interviews. At ROSM alone, it was reported that approximately US$2,000 per day was saved in fuel costs, primarily through use of WFOE—which was initially introduced as a fuel-saving measure on the open hearth furnaces, and the technology was subsequently transferred to process boilers. Future savings may occur at district heating boilers if gas becomes in short supply, boilers are switched over to oil, and WFOE becomes a good candidate fuel.

The development and use of "delta" covers on electric arc furnaces (EAF) had the potential to deliver economic benefits to ROSM as well as an additional 600 smelters across Russia, but an inability to secure licensing for local production and the high cost as well as impracticality of importing finished units from the United States have rendered this option useless to date. So no economic impacts have yet accrued, and none seem likely on the near horizon.

[38] Now a ROLL project.

V. PERFORMANCE

This chapter looks at the performance of MWQ and RAMP in terms of the effectiveness, sustainability, and replicability of subproject tasks.

A. Effectiveness

For the purpose of this study, effectiveness is defined as a measure of how well the intended development assistance met stated project objectives.

Overall, the Moscow Water Quality project shows very positive results in terms of effectiveness. The WWTF component was extremely effective while Istra was less effective than originally hoped (despite some limited on-farm demonstrations) and a very well received environmental education component.

WWTF Component

Application of improved monitoring, reporting, and information collecting techniques to better characterize and control industrial discharges to municipal wastewater plants at three pilot facilities. Development of improved compliance monitoring and inspection programs, leading to more efficient enforcement.

The Russians lacked essential equipment and exposure to new monitoring methods. The project bought and used donated equipment[39]. Russians were trained in their use, and then demonstrations were undertaken at the three industrial sites that also received assistance from a USAID contractor. The work focused on a transition from one point or "grab sampling" to continuous, automatic sampling. This allowed the pollution control authorities to develop a pollution profile of the industrial enterprises and determine if they were discharging illegally during periods when they were not formerly monitored. As a result of using automated sampling, discharges to WWTPs were better managed and, in some cases, reduced significantly.

Additionally, Russian officials were exposed to U.S. water monitoring and enforcement methods and corresponding guidelines. This was accomplished through training in the United States and joint industrial inspections in Russia. Another benefit of joint inspection was that it led to better relations between industry and pollution control authorities. Monitoring equipment use ended long, "drawn-out" discussions about discharges. As a result, the industries have begun to operate at the legal limit and notify the WWTP if there are accidental discharges or "shock loads."

Development of Russian expertise in improved industrial wastewater treatment.

Increasing local expertise in wastewater treatment is one method of increasing drinking water quality. In MWQ, this was brought about in three ways:

1. A local specialist was trained and worked alongside U.S. contractor staff. team interviews revealed that he gained considerable experience through project participation.

[39] The Minnesota Pollution Control Agency (MPCA) and the Metropolitan Council Environmental Services (MCES) donated rehabilitated automatic samplers and other equipment.

2. Expertise in the form of industrial audits was provided for three industrial plants. These audits involved the plant staff, the local consultant, and government wastewater specialists.
3. Government staff, plant staff, and the local contractors all received some training in industrial wastewater treatment techniques.

Application of improved municipal operation and maintenance techniques at three wastewater treatment plants in the Moscow area.

The project worked principally with the WWTPs at Dmitrov, Gagarin, and Tver. Through the use of OMEs, facility operations were improved and maintenance upgraded. The majority of plant improvements can be directly traced to the MWQ equipment provided. In other words, in the absence of this equipment little actually improvements in plant operations would have occurred. This becomes even more apparent when the OME recommendations themselves are viewed because the recommendations point directly to acquiring new equipment.

The OME recommendations can be grouped as shown in Table II. Essentially, the differentiation is between those recommendations that would not have been apparent without the use of project contributed equipment[40] and those that could be made without equipment installation. Recommendations can be further divided into those that are so-called no-cost/low-cost and those that are expensive and beyond the means of project participants. A further distinction can also be made among those recommendations that require either a major policy, legal, or framework change. It should be noted that "low-cost" is a relative term, and measures that the MPCA staff saw as low-cost were, in fact, fairly high in Russia. This is not to detract from the useful work which was done. Clearly, the project (which includes training and equipment) had significant impacts on those plants where the equipment was installed and used.

[40] Equipment was both funded by the project and donated by MPCA.

Table II

Equipment Needs	No-Cost/Low-Cost	Expensive/Major Change
Required	♦ Eliminate heavy metals and detergent in effluents through a strong pretreatment program[41] ♦ Use low-cost options for disinfection	♦ Increase facility capacity ♦ Install automatic monitoring and analytical equipment[42] ♦ Upgrade labs with automated equipment[43] ♦ Develop acceptable options for sludge disposal
Not Required	♦ Experiment with different flow split between WWTF facilities	♦ Reduce flows to WWTP

Dissemination and adoption of municipal and industrial pollution control and prevention techniques beyond the pilot sites to at least an equivalent number in Moscow, Smolensk, and Tver oblasts.

Team visits confirmed that **all** three municipal sites had adopted project-provided, pollution-control techniques. The sites were still using project equipment and had experienced improvement in water quality. Discussions with lab staff confirmed that the use of automatic samplers and flow meters at industrial sites had convinced the industry to reduce waste flows and cooperate to a greater degree with waste control authorities, particularly in the event of the need to send "shock loads." There was also an effective training program that disseminated the knowledge gained by participants. The project also funded a specialist that repaired a number of rural site plants and provided training in Dmitrov. But the limiting factor for adopting the techniques at municipal WWTPs was simply the lack of equipment. There was no adoption beyond the original municipal WWTP.

In the area of industrial pollution-control techniques, both dissemination and adoption took place but not in an obvious fashion, and the project had no explicit mechanism for dissemination. (See discussion on replication below.)

Istra Component

To introduce and demonstrate technologies and management practices that may, if broadly implemented, improve drinking water quality in the Istra watershed and for the city of Moscow.

The Istra project built dams, manure lagoon retaining walls, and manure storage

[41] Staff were using the experience, training, and equipment they received in the project to transfer this to other industries.
[42] The project actually provided this equipment to some of the WWTP and industrial facilities, but its use as a general recommendation would require a relatively expensive outlay in the absence of the USAID–funded project.
[43] Again, this may be relatively inexpensive in the United States but very expensive in the current Russian setting relative to the resources these facilities have at their disposal. The project did provide equipment here.

facilities; worked with local livestock operations; demonstrated manure application; and demonstrated solid waste management. While EPA was introducing this on one or two pilot farms, there was not wider dissemination as looked for in USAID–funded projects as these later demonstration activities were not broadly implemented. An unstable farming and livestock sector, the relatively short-term nature of the project, and the difficult objective to alter lifetime habits all contributed to only very modest changes.

Impart watershed management approach to Russian cooperators.

The Istra project introduced new methods of data collection, measurement and analysis, and intergovernmental cooperation in watershed management activities. With a relatively minor expenditure and use of other resources, the project was able to achieve this goal and bring about a modest, positive change in the institutional milieu.

The creation of a base of critical environmental data on the Istra watershed and the introduction of tools to effectively manage and utilize this data.

Again, the project appears to have effectively accomplished this task. However, by itself, one could argue this is not the best use of donor funds in the absence of the ability (institutional, legal, political, and economic) to use the data. Data by itself is of very limited use in managing the environment but is sometimes a good first step. The local government could have used this data for land use controls, but this was never done.

The creation, introduction, and implementation of an environmental education program for school children and the general public aimed at raising the level of consciousness of environmental issues in the overall population.

Russia had virtually no concept or real experience in environmental education, particularly at the school level. The project accomplished a lot with its resources. Istra worked with the Moscow State University of Geodesy and Cartography (MIIGAiK) and region schools to develop curriculum, train teachers, and train trainers. It also sought to promote or establish a local NGO for environment and work with local media to “spread” the word. Istra developed books and educational material and introduced them to seven public schools. Sequential textbooks for grades 2–5, 6–8, and 9–10 were developed along with other materials, teaching manuals, slides, and films. Environmental articles began to appear routinely in the media, and national conferences were organized on environmental education.

The creation of a small watershed management plan for the Istra watershed that is also suitable for adaptation and application in other small watersheds in Russia.

Watershed management has traditionally been left to several government agencies with few real, on-the-ground results. This activity sought to develop a watershed management plan that was a collaborative process. It was accomplished, and guidance manuals were provided to other regions. Again, its use has been very limited.

Table III

Summary Table of MWQ Effectiveness

WWTF Component		**Istra Component**	
Improved plant operations	Yes	Watershed management plan adopted	No
Improved compliance and monitoring	Yes	Educational outreach	Yes
New methods introduced	Yes	New methods introduced	Some
Training provided and used	Yes	Environmental database working	No
Water quality improved	Yes	Agricultural run-off curtailed	Some

RAMP

Overall, RAMP had mixed results in terms of effectiveness. Its training programs far outweighed any accomplishments resulting from technological upgrades and equipment installation.

Air Quality Monitoring

Based on 1993 pollutant levels, it was decided to focus primarily on particulate matter (PM)—for ambient and source measurements, as well as "technology" recommendations for air pollutant emissions reduction in Volgograd. Sampling focused on the "Triangle" area described earlier.

Almost all Russian sampling systems are based on discrete samples which are typically taken over a 20-minute period (usually three times per day) and are laboratory analyzed. Very little continuous sampling is conducted as the equipment is neither affordable nor readily available. Continuous sampling with electronic devices—as is usually the case in the United States—provides time-resolved data and is invaluable in understanding the relationship between air quality and the sources of air pollution. As such, the 1994 RAMP plan was to implement continuous sampling through the use of high-technology mobile and stationary sampling stations to be provided under CIP. However, the CIP equipment did not arrive until 1997, which seriously delayed the entire effort. In the interim, USEPA planned and conducted field-intensive "saturation studies," using networks of 10 PM-10 samplers, operated simultaneously so as to provide high spatial resolution of pollutant levels and a better understanding of sources and potential strategies for reducing impacts. During campaigns conducted during 1994, 1995, 1996, and 1997, over 1,100 samples were taken throughout Volgograd. Of those samples, 500 were taken during the 1997 study, and 200 of those were subjected to elemental analysis—a procedure which provides information on the proportional contributions of different source types to pollutant level measured.

The air quality sampling program led to the development of local expertise in the performance of air quality sampling studies, built a robust database presenting spatial and temporal distributions of PM-10 (during the intensive study periods), raised interest at the federal level to establish a PM-10 standard, and established a stock of reliable equipment for collecting future PM-10 samples.

Source Assessments and Recommended Control Measures

Source assessments were initially planned for over 40 industries. This was reduced to approximately 20, then 9, and ultimately pursued in detail at just 3 industries [ROSM, Volgograd Aluminum Factory (VAF), and the now-defunct Silica Brick Plant]. Source assessments were intended to serve as a means of identifying opportunities for design and implementation of no-cost, low-cost, and more costly pollution control measures. Optimally, pollution control measures would be no-cost or low-cost or have a near-term positive return on investment (ROI).

Source assessments performed on major industrial source types in Volgograd also resulted in the development of a "Low-Cost Guidance Manual for Selected Industries in Russia, No-Cost Measures" which was produced in 1995. The manual addressed several industries[44] and was adopted by the Russian Federation as an official guidebook in July 1996.

Review of the guidebook by the team revealed that it is primarily a presentation of USEPA AP-42 for selected industries, with no real modifications to accommodate unique features of the Russian processes. Detailed assessments of no-, low-, and significant cost measures were performed for the ROSM, VAF, and Silica Brick factory, in collaboration with USEPA and facility staff and engineers.

[44] Hot mix asphalt, cement and concrete industry, silica brick, primary aluminum production, secondary steel production (recycled and recovered steel, as opposed to primary smelting of iron ore), and volatile organic compounds.

Useful recommended measures in the category of no- or low-cost measures typically included control of fugitive PM emissions, by wetting or paving roadways, wetting storage piles that might be sources of windblown PM, or by "adjustments" of fuel or air to boilers and furnaces to improve fuel efficiency and reduce particle emissions and gases. Other measures were recommended for the VAF (wetting of roadways), Silica Brick Plant (wetting of roadways and storage piles) and Volgograd Tractor Plant (use of phenol-free water for quenching of tempered parts and recovery of scrap and high magnesium-content slag for reuse).

Higher-cost technologies focused on opportunities at the Red October Steel Mill (ROSM)—primarily the "precast delta" scheme for EAFs[45]—and at the VAF. VAF was and remains in much better financial condition and is implementing recommended and additional measures at its own expense. The majority of project funds for costly pollution control measures focused on the ROSM "precast delta" scheme, which to date has been a failure. Some of the reasons are:

- Extended delay (18 months) in delivery due to problems with clearing customs in St. Petersburg;
- Probable degradation of material properties of the "precast delta" due to exposure to the elements while in the customs "laydown" facility;
- Premature destruction of the delta due to rupture of the cooling water ring and subsequent breakup of the delta on removal;
- Discrepancy in choice of materials and design, as the "U.S. design" is based on

[45] Electric Arc Furnaces.

continuous steel production while most of the targeted mills in Russia are batch-type (thereby exposing the delta to cycling of temperature, expansion and contraction and probable accelerated material deterioration);

- Subsequent inability to demonstrate the "full duty" cycle of the delta on Russian EAFs; and,
- Inability to come to agreement on local delta licensing and Russian production as the licensing fee exceeds the local ability to pay, and import of finished deltas, or possibly even the proprietary ceramic mix, is too costly.

Emissions Inventory

The emission inventory effort was also downward adjusted to include only those sources in and around the "Triangle" defined by ROSM, VAF, and the Silica Brick Plant. The purposes of the more targeted emissions inventory were to provide data for use in the prioritization of air quality control measures and for the health risk assessment to be performed by USEPA and its cooperators.

The emissions inventory scope reduction was a result of delays in receipt of air quality sampling and source testing equipment procured under CIP and delays in execution of other preceding tasks. In particular, source sampling equipment that was essential for the development of improved emission factors. These factors, in turn, would have provided for a more accurate and time-resolved emissions inventory (i.e., emissions as a function of process rates).

For the limited area addressed by RAMP, the emissions inventory seems to have been successfully conducted. However, changes in operating rates and plant closures have changed actual emissions thus compromising the usefulness of this entire effort.

Emissions Testing

RAMP's emission testing was designed to provide data to improve the accuracy of process rate–based emission factors and to demonstrate the relationship between visible emissions (VE) and the corresponding emission mass.

Implementation of testing resulted in the training of Russian environmental inspectors, industry environmental staff, and ministry officials in the performance of VEs. Correlational studies between USEPA–approved and Russian extractive source testing measures were also performed, and a smaller number of individuals were trained on the use of the sophisticated continuous analyzers provided by USAID under the CIP.

The team observed that the Instrumented Source Testing Trailer provided under CIP—which cost in excess of US$250,000—appears to have been out of use, as it is stored in a secure bay at an engine factory, two tires are flat and have been for quite a long time, and other signs as well indicate that it has been a long time since it has been used. Based on interviews with officials, RAMP did provide useful training on the planning and execution of source testing programs, quality assurance and quality control (QA/QC) procedures, and development of upgraded Standard Operating Procedure (SOP) documents.

Collaborative training efforts between VESA, USEPA, and CIP also assisted in assuring that the VESA environmental laboratory was upgraded to accommodate source testing sample analysis requirements.

Human Health and Risk Assessment

RAMP's health risk assessment component was intended to estimate the impacts of air pollution emissions on Volgograd's population. Tools used in support of this effort included performance emissions testing, the development of emission factors, and the measurement of baseline air quality and health impact estimates. These risk assessment results were to be used to prioritize the relative importance of pollutants and their impacts and to thereby serve as the basis for prioritization of planning and regulatory action.

RAMP tasks also included the development of a detailed inventory of sources and source parameters in the "Triangle" study area. Appropriate source emissions and meteorological data were acquired, and an appropriate USEPA dispersion model was used to estimate impacts under various operating scenarios and meteorological conditions.

As a result, methodologies for determining the most cost-effective targets and measures for reducing impacts on human health were initially developed under RAMP and later utilized in the air quality management planning by VESA and affected industries.

Compliance and Enforcement

Compliance and enforcement training and program development efforts undertaken under RAMP were intended to improve the abilities and resources of VESA to conduct regulatory compliance inspections, to improve the existing system of fees and fines, and to promote USEPA Method 9 as a tool—initially as a compliance standard, but eventually as a compliance indicator. Impacts of the compliance and enforcement improvement program included:

- Introduction of the VE program, ultimately as an indicator of compliance status;
- Demonstration of the relationship between VE (government unregulated) and mass emissions (government regulated); and,
- Furthering of the concept of setting realistic fees and fines as a means of internalizing the costs of noncompliance.

Public Participation

The public participation component of RAMP was initiated in May 1995 at the start of the second half of RAMP. Public awareness and participation are important components of any successful AQM program. It appears that public participation assumed a higher importance (and budgetary allocation) when it became apparent that delays in RAMP and CIP implementation of more technical components would limit project fund usage. As a consequence, RAMP–supported public participation activities were increased. Such activities were also more compatible with the abilities of many talented but nontechnical staff.

Public participation was broad and deemed useful. It included:

- Formation of the Volgograd Citizen's Environmental Task Force (VCETF);
- Planning and execution of media campaigns, including television and radio advertisements, distribution of fliers and brochures, newspaper articles, and public hearings on air pollution issues;

- Creation of permanent and traveling environmental exhibits, under the Inter-Regional Exhibition of Resource Materials program;
- Publication of a 40-page directory of environmental organizations in Volgograd, including government agencies, academic departments, consultants, NGOs, and other private sector organizations;
- Organization of the “Green City” campaign, which supported local tree planting programs in green spaces and information delivery events in city parks; and,
- Creation of a “Children’s Smoke School” to teach students about air pollution and the sources and impacts of visible emissions.

The public participation program increased awareness of environmental matters, helped develop appropriate printed and reference materials that were previously nonexistent, and elevated environmental quality to a “political issue” at the city administration level (environmental awareness was cited as a key issue in a recent city administrator election).

Training

The primary vehicle for training under RAMP was the CET. CET was formed in October 1995 as the result of collaboration between RAMP, a U.S.–based NGO, and USEPA. CET was opened under the auspices of the Russian Ecological Academy and was also supported by Russian partners which included VESA, Volgograd City and the *oblast* administrations, local businesses, industries, and NGOs, as well as the then-existent Ministry of Environmental Protection and Natural Resources (MEPNR). The training program offered over 20 programs to more than 400 participants. New courses were developed, USEPA courses were adapted and translated, and assistance was also received from USEPA–trained staff from the CET located in Ekaterinburg.

Trainees included government inspectors, technicians and managers from the city and *oblast* level, as well as individuals from industry, NGOs, academia, and concerned citizens. During early 1997, CET received its license for ecological education from MEPNR’s successor organization, the Russian Federation State Committee on Nature Protection, thereby enabling CET to charge for training services.

Table IV

Summary Table of RAMP Effectiveness

Air Quality Monitoring	Yes
Source Assessments & Recommended Control Measures	Some
Emissions Inventory	No
Emissions Testing	Yes
Human Health and Risk Assessment	No
Compliance and Enforcement	No
Public Participation	Yes
Training	Yes

B. Sustainability

Sustainability is defined as the degree to which a program continues to provide benefits beyond the end of development assistance.

WWTF Component

USEPA was acutely aware of the need for program sustainability and for this reason emphasized training, no-cost/low-cost methods for water quality improvements, and institutional strengthening.

Except in those circumstances where an industrial enterprise had closed, all project activities were sustained to a high level three years after project completion. Some of the project-provided or project-donated equipment had routine repair problems, but the local authorities had clearly demonstrated its usefulness and were able to obtain funds for needed repairs.

Financial sustainability

Russia's wastewater infrastructure is mostly outdated and inadequate by most accounts. Without exception all those interviewed indicated that current funds were insufficient to meet operating needs, much less any capital spending improvements. Sustainability revolves around funding. The project contributed to financial sustainability in at least two ways. The project provided equipment and training to the water testing laboratories that allowed them to become certified. Certification, in turn, allowed them to perform services for a fee to the private sector—a growing source of new and sorely needed income. The project reduced costs at municipal treatment plants by identifying some no-cost adjustments, allowing them to do more within a fixed budget.

Institutional sustainability

The WWTF component contributed to institutional sustainability in two main ways. First, it facilitated improved relationships between environmental management authorities and dischargers. That is, through the use of new equipment and techniques for sampling and monitoring and through joint training in the United States, industry and government authorities resolved many conflicts and were seen as partners in a "process." This reshaping of roles helped establish credibility for the government in the eyes of industry and helped government better see the problems industry faces and their role in helping to solve problems. WWTF helped move local government from only an enforcement agency role to one that helps industry solve its problems.

Second, the WWTF component provided staff with a renewed sense of purpose and direction in water quality management. Further, this was institutionalized through training and through strengthening existing training programs. Training[46] was a main feature of the WWTF component, and yet most staff had little formal training. The project exposed Russian staff to modern U.S. methods and procedures, by bringing them together to form multidisciplinary teams. The project also sought to strengthen the Environmental Training Center in Smolensk and use it to train other *oblasts* and to assist WWTFs in obtaining additional training funds.

Istra Component

Istra project officials rightly concluded that sustaining many of the demonstration activities would be difficult, given that some staff had already left the project prior to its end and given the very unstable economic condition associated with agricultural production, access to markets, etc. But this begs the question: Why not factor that in at the project's inception? Some of the physical structures that were built are still used by operating companies and by farmers. The continuance of management and farming practices was not observed, but anecdotal evidence suggests some modest follow-on. For example, of the two livestock farms (deemed major polluters), one closed during the project and the other has sold off the majority of its animals. In short, the project demonstration activities were undertaken in conditions that did not promote any real likelihood of sustainability. It appears that the up-front choice of the demonstration sites was a known risk in terms of continued farm operation.

Environmental education and activities focused on institutions, on the other hand, have taken root and flourished. The team found evidence that many of the education materials were still being actively used.

Financial sustainability

Farms and agricultural enterprises were undergoing significant change before and during the Istra project. The project itself, however, did not significantly contribute to the financial viability of these entities or activities and thus could not be expected to ameliorate drastic economic conditions. Institutions and education are another matter. Books produced in the project are now sold to other school districts, and ecological funds derived from sales are still being used to support continued educational efforts. Environmental education is still seen as important and commands respect.

Institutional sustainability

The project attempted to contribute to institutional sustainability through training, product development, and skills transfer. Several planning and management institutions that participated in the project are still operating and applying what they learned in the project to their work, but interviewees all agreed that the project added little to institutional sustainability.

[46] Training by itself is not a mechanism for sustainability. For the impact of training to be sustainable, the training itself must be sustained. New entrants must receive training, and old employees require refresher courses and updating on new methods and technologies.

Table V

Summary Table of MWQ Sustainability

	WWTF Component	Istra Component
Financial	Yes	No
Institutional	Yes	No

RAMP

Air Quality Monitoring

Air quality monitoring systems introduced in Volgograd proved to be "sustainable" only in the case of PM-10 sampling as these systems are easy to operate and repair, require low maintenance, and have low operating costs. There is a substantial reserve of spare parts as 40 samplers were delivered. However, only four or five samplers are currently operating. Even this very reduced program is at present sustainable only with full support from VESA. The continuous air sampling equipment does not appear to be in operation, due to lack of spare parts, calibration gases, and operator resources and is thus not sustainable.

The analytic laboratories, as designed and equipped by USEPA and CIP, are not currently sustainable without substantial funding from VESA. The laboratories provide important data on water quality including recent studies on heavy metals in the Volga River and riverbed. While there is a small amount of work coming in from industries, the expected volume of contracted work payment for such services from other industries and environmental programs has not materialized. This is primarily due to the high cost of analysis in Russia.

Source Assessments and Recommended Control Measures

The performance of source assessments has become a "marginally" sustainable commercial service. This is because vertical integration and provision of design and process engineering services are typically required to make such services profitable, and this has not yet occurred.

Most specific no- or low-cost measures did not provide measurable savings in operating costs and in fact required some level of expenditure by the implementing firm. One notable exception is the emulsification of diesel oil at ROSM. Using an inexpensive motor/impeller assembly, ROSM has developed a method by which fuel use and pollutant discharges have been significantly reduced.

Emissions Inventories

The team judged the emissions inventory effort as sustainable, provided that VESA continues to review and integrate test data and annual operating report data into the database—and that industry "truthfully" reports its emissions, which is highly variable in accuracy and intent.

Emissions Testing

Two physical forms of emissions testing were introduced under RAMP: USEPA extractive source sampling—using expensive and high-cost continuous analyzers and stack probes—and visible emissions (VE) testing. A third form of emissions testing introduced under RAMP was based on estimation of emission rates as a function of process rates and emission factors. Use of continuous analyzers, as housed in the "CIP–provided mobile trailer," has not proved to be sustainable as operating costs exceed resources and prospective clients are typically unable to pay for the services. As noted earlier, the trailer, on inspection, is not functioning.

VE testing has also proved to be unsustainable, due to lack of integration of the method into a legally enforceable procedure for compliance testing and demonstration. Lack of sustainability is attested to by the fact that over 180 VE observers have been trained and certified, but since the last certification program was conducted in September 1999, there have been no new certified VE Russian observers.

Emissions estimates based on emission factors, if accepted as a surrogate for emissions testing, have been used in Volgograd and with good results. This method provides a much quicker and cheaper means of estimating and reporting emissions and is reasonably accurate if operating conditions and process rates are compatible with conditions valid for application of the emission factors.

Human Health and Risk

Human health risk assessment, not a principal feature of RAMP, could be a sustainable activity provided the emissions inventory, dispersion modeling capabilities, meteorological data, and demographic data are periodically updated. Furthermore, when it became apparent that HIID and the CDC were conducting work in this area, RAMP curtailed its human health and risk activities. Sustainability costs should be low.

Compliance and Enforcement

Compliance and enforcement activities in Volgograd and elsewhere in Russia are supported by emission fees and fines as well as incremental local government support. However, fees and fines rarely cover operating costs for compliance and enforcement activities. Sustainability of the RAMP–provided VE component is unlikely if the method is not adopted as a regulatory standard at the federal level. Neither compliance nor enforcement were key efforts under RAMP.

Public Participation

Continuation of public participation, strengthened under RAMP, will be possible only through provision of renewed support by VESA, the city administration, concerned industries, NGOs, and international development assistance agencies. Generally, public participation is not a productive undertaking in and of itself. However, increased public awareness can and often does lead to increased pressures for environmental quality improvements, which can, in turn, lead to process efficiencies, reduced operating costs, reduced health impact costs, and a positive cost benefit. This assumes all previously identified external factors are properly valued and included in the cost–benefit analysis.

Training

The training function established under RAMP resides primarily in CET and with its contractors. At present, revenues from training are not sufficient to sustain CET. It currently relies in part on funding from VESA and the "hope" for additional ROLL grants—which are useful but insufficient to assure sustainability. CET also requires further support in development of its trainer cadre as the short period of activity under RAMP does not provide sufficient time to develop fully skilled trainers in all desired subject areas.

Table VI

Summary Table of RAMP Sustainability

Air Quality Monitoring	Yes
Source Assessments & Recommended Control Measures	Some
Emissions Inventory	Yes
Emissions Testing	No
Human Health and Risk Assessment	No
Compliance and Enforcement	No
Public Participation	Uncertain
Training	No

C. Replicability

Replicability is defined as to whether assistance provided to target *oblasts*, institutions, and industries has spread to others within the Russian Republic.

WWTF Component

The greatest replication success under this component was in training, monitoring, and inspection. Impressive training has been replicated through the nearby Smolensk Environmental Training Center. Through a ROLL grant, the Center went on to train over 300 additional persons. Monitoring and inspection have also been replicated. Staff continue to apply the techniques learned at dischargers other than those directly included in the project. For example, the team found evidence that staff have moved monitoring equipment located at one industry to another (Tver *oblast*). Additionally, non-targeted laboratories are now certified and equipped, and some are providing their services to industry for a fee.

Despite these specific successes, there has been little full-scale replication beyond the original WWTF sites for which USEPA provided equipment. The team found evidence that the Smolensk laboratory did use a ROLL grant to apply OME to one new municipal WWTP, two rural plants, and one industrial facility. Sufficient time has not elapsed, however, for funding these recommendations.

On the industrial side, there has been some limited replication. Green Frog, a participant and service provider, has used the knowledge it gained under MWQ to actively pursue new industrial clients. Since 1997, the service provider has some 60 wastewater treatment customers that it attributes directly to its involvement in the project.

The reasons for this lack of strong replication in wastewater treatment are straightforward. But who was actually responsible for this is not entirely unclear. USEPA may have underestimated the obstacles to replication, even though they clearly listed them in their workplan as constraints. "Environmental investments by industry have largely been put on hold as enterprises attempt, with varying degrees of success, to put what little money they have into production improvements and make the change to a market-based economy."[47] Or, USAID may not have given sufficient guidance as to the need for replication beyond the demonstration sites. What is certain is that replication did not occur.

Istra Component

There is hardly any evidence to support replication of the demonstration activities under this component. Moreover, this shortfall could likely have been anticipated at project inception. However, replication of environmental education has been a great success. The Istra region has gone from seven schools (grades 2 through 10) to 28 schools at all grade levels. Monthly practical activities are undertaken such as environmental cleanups. Environmental education has spread beyond Istra. Almost all schools in the Moscow *oblast*, for example, now teach environmental education, using the materials developed under the Istra component. Text books are now in their second edition and are being sold to schools throughout Russia.

[47] USEPA Country Workplan for Russia, 1996, p. 13.

Table VII

Summary Table of MWQ Replicability

WWTF Component		Istra Component	
Improved plant operations	No	Demonstration sites	No
Training and monitoring	Yes	Small watershed management	No
Inspection	Yes	Educational outreach	Yes

RAMP

With two exceptions (boiler fine-tuning and fuel oil emulsification), evidence of RAMP–specific replication is limited. The text below, therefore, focuses on existing activities which show potential for future replication.

Air Quality Monitoring

The only components of the air quality monitoring effort that have potential for replication at present are the use of the DC or AC-operated PM-10[48] samplers for the purpose of special studies and the gravimetric digital balances and laboratory analytical equipment provided under CIP. There was no evidence that the RAMP PM-10 sampling program was replicated. Unless equipment and operating budgets are contributed or subsidized by others, replication seems doomed.

Similarly, it is also unlikely that the laboratories equipped under RAMP and CIP can be replicated, due to the high cost of operation and currently insufficient volume of outside contract work. This work was expected as a source of operating income but never materialized.

Source Assessments and Recommended Control Measures

Source assessment procedures, to identify opportunities for pollution reduction and prevention, are currently offered by several consulting firms in the Volgograd area. Most of these firms received some training or direction from RAMP. Such services are also offered elsewhere in Russia, totally independent of RAMP efforts. When offered as a vertically integrated service along with the design of pollutant control devices, this activity could be attractive for replication.

As regards control measures, it is likely that wetting of roadways and storage piles could become a more frequent practice in the reduction of fugitive particle emissions. Fine-tuning of boiler firing procedures and air-to-fuel ratios, as initially developed under RAMP, have been observed at other facilities in Volgograd; however, there was no clear linkage to the project *per se*.

Use of the fuel oil emulsification process at ROSM has already been used elsewhere in Volgograd and is being replicated beyond Volgograd. If gas becomes more scarce during the winter and heating boilers are

[48] It should be noted that the PM-10 samplers can also be fitted with PM-2.5 impactor heads, for studies of respirable particle loadings. However, the method has not been accepted as an Equivalent Method by the USEPA (though it could be if the owners decided to pay the price of having this done), nor is it recognized as an acceptable method for determination of compliance with Russian AQ standards. The latter will certainly limit replication of use of the technology.

converted to oil firing, it is likely that even more units will be fitted with fuel oil emulsification systems.

Replication of the “precast delta” approach for EAFs is possible but did not occur. Replication will depend on the ability of Russian counterparts to negotiate favorable terms for local production—or to develop a patentable modification thereof that will achieve the same results. To date, this has not occurred.

Emissions Inventories

The practice of constructing improved emissions inventories could be replicated in areas that exceed norms and are under order to improve air quality. Such inventories could also be replicated in areas where public pressure for improved air quality is high as accurate inventories are an essential tool for development of successful AQM schemes.

Emissions Testing

Emissions testing using USEPA–approved continuous analyzers and extractive sampling has not been successfully replicated elsewhere. This is due primarily to operating costs, difficulty in transporting equipment across great distances, and the inability or lack of desire to pay for such services by potential client industries. VE testing has also not been replicated elsewhere due to a lack of regulatory acceptance of the method for compliance and enforcement.

Human Health and Risk

Performance of human health risk assessments could be done, provided an accurate emissions inventory, baseline air quality, and health data, as well as representative meteorological data are available. Such air quality–related risk assessments would be very useful for AQM planning in other cities but awaits further demand.

Compliance and Enforcement

The primary compliance and enforcement activity introduced under RAMP was the VE system. This was not replicated. Until VEs are required by law, it is unlikely that this part of the compliance and enforcement program will be replicated. This is further attested to by the virtually nonexistent current demand for VE certifications.

Public Participation

Some public participation techniques have been replicated in other cities, primarily through the work of CET and its involvement in public awareness, educational, and NGO organizations. Whether or not this can be directly linked to RAMP is indeterminate.

Training

Some components of training have been replicated in parallel at other locations during the course of RAMP. Until government regulations and demand for regulatory compliance increase, it is unlikely that training organizations will be able to provide services in the absence of outside funding and support[49].

[49] Perhaps government subsidy of such an organization—similar to the USEPA’s Air Pollution Training Institute (APTI)—would lead to overall increases in efficiency and accuracy in the demonstration of environmental compliance by regulatory agencies, industry, and their consultants.

Table VIII

Summary Table of RAMP Replicability

Air Quality Monitoring	No
Source Assessments & Recommended Control Measures	Yes
Emissions Inventory	No
Emissions Testing	No
Human Health and Risk Assessment	No
Compliance and Enforcement	No
Public Participation	Some
Training	Some

VI. LESSONS LEARNED

This CDIE Impact Study examined a number of now-completed urban and industrial pollution programs and projects in Russia. Hindsight is always a "perfect teacher," and as pointed out in the Program Elements section, the purpose of this USAID series is to inform the design of new Agency programs and activities worldwide. Since this evaluation is retrospective in nature, it is not always possible to know the exact project- and country-level circumstances at the time of project implementation. At the same time, much can be learned about how to plan future sustainable developments activities. Presented below are the lessons learned from USAID's Russian experience.

1. **Low-cost and no-cost (LC/NC) pollution control methods were emphasized in Russia as the first step to improve environmental quality. Yet in some cases, these recommendations were not based on a full understanding of the reasons why LC/NC may not be adopted, sustained, or replicated. Interviews with Russian plant managers, facility operators, and others suggested that before jumping to a LC/NC solution, activity designers should consider tight money, market imperfections, industrial technology, and risk.**

A. Tight-money. In effect, there is rarely a no-cost option. One way to understand this is to use two common definitions for no-cost. The first means that there are no out-of-pocket costs. Out of pocket costs are only one aspect of the decision process however. No-cost options entail use of resources and always have an opportunity cost. They may require the use of labor, for example, to regularly install filters. In resource-strapped, understaffed, municipal wastewater treatment plants in Russia, the opportunity costs of staff and resources are quite high. Furthermore, no-cost options often rely on changing behavior, and this too is not so inexpensive.

The second definition of no-cost is one that entails no "net cost" to the entity. That is, revenues or cost saving to the entity outweigh the cost of the intervention. Net cost is often estimated by engineers in terms of payback times. For example, steam traps and insulation are often considered no-cost/low-cost because they have relatively short payback times. Yet, many businesses do not adopt these no-cost/low-cost methods because they cannot find the funds even though small upgrades could generate high returns. This was a prime reason given by municipalities for not expanding the lessons they learned from MWQ to their other plants. Similar arguments were voiced by those associated with RAMP.

B. Capital markets imperfections. No-cost/low-cost methods are determined by calculations (implicit or explicit) that consider that funds are available at the market rate and that there is no capital rationing. The on-the-ground reality is often quite different. There is an adage that you must have money to make money. In the development context, it might be said, "you must have money to save money." Discussions with MWQ staff and especially those familiar with RAMP revealed that the lack of capital was one of biggest obstacles preventing the adoption of no-cost/low-cost methods in Russia.

For example, municipalities often cannot access capital markets, and city governments are often cash strapped. Additional funds, if available at all, often have higher uses than municipal pollution upgrades such as paying staff or covering operating costs for electricity or chemicals. For those industries still in operation during hard economic times (as in Russia during the 1990s), the market rate of interest may not adequately represent industry opportunity costs. Faced with basic survival issues, industry managers interviewed said they were more likely to use any additional capital to retain "market share." In other words, even modest expenditures are often effectively restricted under such market conditions.

C. State of industrial technology. The application of no-cost/low-cost pollution prevention and wastewater treatment is not always advised as a first step. In economies like Russia's which are transitioning from government-owned industry or central planning into private hands, much of the industrial technology is usually so outdated that no-cost/low-cost can only represent a temporary and marginal improvement. Interviewees often commented that the most important move for industry may be to completely modernize, and this means more than marginal changes in technology. It may mean completely new processes are needed to produce significant environmental improvements. For example, in considering some RAMP activities, venting and controlling emissions from Russia's open hearth steel furnaces will rarely make them competitive with today's electric arc furnaces.

D. "Near-Death" Industries. Investing in the most troubled industries is always risky. If the environmental problem is responsible for the industry's financial conditions such as discharge of valuable raw materials, then USAID investment may be warranted. Otherwise, an improvement in emissions at outdated industries simply means that the inefficient, noncompetitive plant is simply a little cleaner. These changes will be insufficient to keep the plant in operation however. It will fully modernize, or it will close down. But in either event, the earlier USAID environmental development assistance is now useless. Before upgrading moribund industries, activity planners need to be more certain those industries are really a good donor investment.

2. **Pilot and demonstration projects to curb air and water pollution will not be replicated unless planned from the start. Such plans must be built into the implementation phases. Successful replication may require different skills, expertise, and potential capital sources than a demonstration.**

Over the years, replication of development assistance results has proved to be one of the hardest challenges facing USAID and other donors. In 1992, USAID chose to work with a very limited set of pilot and demonstration sites in Russia. In part, this was done because of the enormous environmental challenges Russia inherited, the vastness of its landmass, an unstable regulatory situation, government fragmentation, and project budget realities. Little time was spent asking the question: How will USAID projects spread to other locations and industrial enterprises? Working only with pilot sites will not yield replication and when regulatory "demand" is either low or nonexistent, replication is further doomed. Replication must be integral to project design—at the implementation stage—and not an after thought.

Providing industry with rate-of-return information can help with replication. Often, the profit-making nature of firms may make them resistant to adopting a new, potentially expensive, pollution-reducing technology unless there is a demonstrated economic benefit. Simply presenting an industrial enterprise with the "facts" but not the real costs does not guarantee that the firm will adopt the technology. Furthermore, in a market economy, there is no incentive (some would say there is actually a disincentive) for a firm to share this information with others. In order to replicate the positive impacts of a pollution prevention and reduction activity that targets industry, project planners need to carefully and deliberately present the financial benefits of adopting these technologies. To be sure, there were distinct and formidable difficulties in Russia during this period surrounding the availability and reliability of data as well as the status of Russia's "transition" toward a market economy. These points notwithstanding the project would have been better served if financial information was presented and shared.

Showing that an economic benefit will result from a new technology can be in the form of reduced fees and fines based on lower emissions or increased profit through the recovery of materials that can be recycled back into the production process. Interviewees told the team that when a new technology is introduced, firms should first be presented with convincing return-on-investment information and not just consultants' best estimates. Demonstration of real cost savings, in a hard-pressed economic operating environment like Russia, will increase the likelihood of adoption and replication.

3. Appropriate, not necessarily new or state-of-the-art, methods, procedures, and technologies must be used.

The work of USAID's implementers in Russia often focused on providing technical advice to improve municipal operations (Moscow Water Quality) and industrial processes (RAMP). And, in the case of RAMP, there was a strong emphasis on getting the "right equipment" installed in the most polluting Volgograd industries. The right equipment and what it takes to have sustained impact, however, did not all come together as well as expected. Why? In-depth interviews and on-site visits revealed that much more attention should have been focused on the "operating environment" which is distinct from the equipment *per se*.

To make the best use of equipment, it is essential to fully understand and appreciate the "operating environment" for that equipment. This was not done in Russia. In the future, implementers must carefully examine:

(a) Availability of trained staff and other necessary support services (including operations, calibration, preventive maintenance, and repair) and expendable supplies necessary for continued operation of the device or equipment;
(b) Physical environment, including exposure to elements, pollutants, abuses inherent to the application;
(c) Regulatory and legal acceptability of methods and procedures (e.g., sampling and analysis of pollutants or proposed pollutant control technology); and
(d) Level of precision, accuracy, and spatial and temporal resolution needed.

Unless these elements are given close scrutiny, and not just the equipment specifications, the chances of long-term impacts being sustained are severely undermined. Needless to say, no methods or procedures will do the job if management is not predisposed to cutting waste, saving costs, and improving operations. Equipment (appropriate or state-of-the-art) alone can only go so far.

4. **Operational funding, beyond the initial capital cost of pollution prevention equipment or other abatement technology, should be committed and assured.**

In Volgograd and elsewhere under EPT, project provision of equipment and even a fuller understanding of the "operational environment" proved to be not enough to sustain the program. What else was needed? The simple answer is funding for more long-term operations. In other words, the technology, method, or procedure provided will not operate as planned, or will cease to function if sufficient funds to support operator costs, maintenance, repair, and expendable supplies are not budgeted or other sources identified. While operational funding is not traditionally considered part of the "operating environment" in the United States and developed countries (where there is access to multiple funding opportunities), this proved to be a serious problem in Russia. For example, implementers must ask whether there is enough funding to obtain initial governmental certification and cover testing costs. Will there be acceptance of the technology by the Russian regulatory authorities? Will the method or procedure require new outlays after start-up for preventive maintenance, operations, repairs, and expendable supplies?

To maximize sustainability, implementers must look at funding sources beyond project assistance which include environmental fees and fines collected from industrial sources; support from local, *oblast*, or federal agencies; other development assistance agencies and cost sharing; and proceeds of sectoral or other loans from domestic and international financial institutions.

The important point is that implementers will be blindsided and the project substantially weakened if they do not take into consideration the need to secure operational funding beyond capital costs.

5. **USAID must be clear whether it seeks shorter-term results, with more immediate and visible environmental impacts, or longer-term results with sustainable impacts and durable institutional partnerships.**

A. Project start up. EPT was officially launched in 1992 at a time when the U.S. government and other donors were moving swiftly to be among the first supporters of the "new" Russia. There were legitimate political and financial reasons to have some early successes to bolster the emerging Russian democracy. USAID relied heavily on the technical expertise of the U.S. Environmental Protection Agency (USEPA) to take the lead in reducing pollution because of its demonstrated expertise and well-established contacts with Russian professionals under a series of Soviet-era training and exchange programs.

Team interviews with project staff and other donors revealed that USEPA–led activities got off to a slower-than-expected start, but their presence at key field pilot sites and around Moscow was acknowledged early. More lead time for project start-up and host-country needs analysis would have improved communication among U.S. and Russian partners and otherwise allowed for a more targeted and sustainable effort. But timing was absolutely essential for EPT advocates because swift implementation was one of its paramount goals. A more studied approach may have produced more widespread and sustained impacts but at the expense of a more immediate, visible USG presence and budget drawdown.

B. Institutional staying power. Durable partnerships and well-functioning environmental institutions take time to coalesce and operate, especially in transition countries like Russia. Russia's environmental institutions are understaffed and underfunded. Interviews with MWQ and RAMP officials confirmed the need for on-site engagement—not occasional visits with concentrated bursts of activities. While the wastewater projects were successful in many ways, the impact of U.S. assistance might have been even greater. Institution building and strengthening requires a slow, steady plodding and a presence that helps institutions on a day-to-day basis. Changing institutions and people requires developing an understanding, dealing with problems while they happen, overcoming obstacles when they arise, and learning through observation—which may not take place when short-term technical assistance just happens to be in-country. USAID must be clear whether it seeks shorter-term results or longer-term impacts yielding ultimately stronger institutions. Finally, interviews with some donor officials suggested that the typical kind of leveraging that USAID works hard to secure was partially undermined by the need for a more prompt, on-the-ground presence in Russia.

ANNEX A: RUSSIA EPT EVALUATION METHODOLOGY

SOURCE MATERIALS:

Primary project documentation was collected in Washington from USAID's archives, project staff in the Agency's Europe and Eurasia Bureau, USEPA's Headquarters and Regional Offices, and from staff in USAID/Moscow. Documentation was generally good but located in disparate locations. The RAMP final report was still in preparation when the interview process began in September 2000.

WASHINGTON INTERVIEWS:

Entrance interviews and subsequent meetings were conducted with staff from USEPA's Washington-based Office of International Affairs and Office of Ground Water and Drinking Water, also located in Washington. Phone interviews were conducted with USEPA Office of Air Quality Planning and Standards (OAQPS), and extensive interviews were also held with staff from USAID/Washington's Europe and Eurasia Bureau.

RESEARCH QUESTIONS AND DATA COLLECTION:

The study team developed a set of preliminary research questions for each EPT project in Washington. Questionnaires linked to the research questions were later translated into Russian in-country.

FIELD INTERVIEWS:

The CDIE team reviewed all questionnaires together in Moscow to establish a common protocol before dividing into two separate data collection teams to cover both EPT projects (Moscow environs and Volgograd).

SAMPLING:

MWQ—Component I: Interviews were conducted at all three WWTF sites and with several industrial enterprise managers or their successors.
MWQ—Component II: Interviews were conducted at the implementation site (Istra) and with staff from various Istra components.
RAMP—Interviews were conducted with several industrial enterprise staff, managers, or their successors in Volgograd. Further interviews were conducted with Volgograd Environmental Services Administration (VESA) and Center for Environmental Training (CET) staff.

ANNEX B: COMMODITY IMPORT PROGRAM

The Commodity Import Program (CIP) was a two-year, US$125,000,000 grant program intended to support commodity procurements in six key sectors of energy and environment. CIP's primary goals were to:

A. Introduce U.S. technologies and equipment with the goal of stimulating Russian partnerships and trade.
B. Demonstrate energy efficiency, waste minimization, and safety in the workplace (the latter primarily in the coal sector).
C. Strengthen the sampling and analysis capacity of Russian environmental protection agencies.

The total amount spent was subsequently reduced to US$61,500,000 due to Congressional rescissions and USAID program cutbacks. Sectors targeted, disbursements (rounded to the nearest US$100,000), and primary objectives are listed below:

1. Natural Gas (US$4.0 million): improve transport and distribution and reduce leakage thereby reducing greenhouse gas (GHG) inputs of methane.
2. Oil (US$ 8.5 million): use flared gas and leak reduction.
3. District Heating (US$10.1 million): adoption of metering, insulation, improved controls, and reduced system losses.
4. Power (US$10.4 million): improved energy management, dispatch and process controls, and environmental control equipment.
5. Coal Mining (US$4.2 million): install and upgrade health, safety, and methane-recovery equipment.
6. Environmental Protection (US$24.3 million): strengthen the measurement and control of air and water pollutants and solid waste generation and disposal.

Of importance with respect to the USAID's Moscow Water Quality (MWQ) and Volgograd Russian Air Management Program (RAMP) were CIP "Environmental Protection" funds (US$24.3 million). By design, they were not invested in components that linked to these two EPT subprojects[50]. Such a collaborative approach would have improved successes in proper specification, training, and end-use of CIP–provided commodities, etc.

In the team's view, MWQ and RAMP were not sufficiently funded to accommodate the capital costs of equipment required to fully execute their respective tasks. Both projects relied on an

[50] USAID deliberately separated EPT (and RAMP) from CIP on the assumption that the purpose of EPT was to provide American advisors for their Russian counterparts, while that of CIP was to provide financing for equipment for Russian counterparts. In other words, CIP funds should not be used to contribute to the success of EPT which had its own funding. Though many instances of using CIP funding to procure equipment critical to success of EPT, MWQ, and RAMP components occurred (over US$3,000,000 for water quality laboratory equipment in the MWQ area of operations, and over US$3,000,000 for air and water sampling as well as air and water analytic laboratory equipment for RAMP), the near-total disconnect between CIP, MWQ, and RAMP—from a technology and field applications perspective—further compromised realization of the full potential of MWQ, RAMP, and CIP.

"unofficial dependence" on CIP–procured equipment for the success of several components and tasks. While the environmental laboratory equipment has proved to be somewhat useful in both Moscow and Volgograd, the dependency also produced delays and operational problems, such as:

1. Analytic laboratories supported by MWQ and RAMP were not given the opportunity to specify the types of equipment that *they* desired. As a result, some equipment is not being used due to lack of expendable supplies or lack of governmental approval of the methods.
2. Air quality sampling, source testing, and analysis equipment supplied to Volgograd far exceeded the technical requirements and financial ability of Volgograd Environmental Services Administration (VESA) under then-current conditions. Almost all of the ambient monitoring and all of the source testing and smoke generator equipment is not being used at present.
3. Specifications, often provided with the assistance of MWQ and RAMP advisors, were not always met. This most likely occurred because CIP qualified procurement specifications as "or equivalent," and then were unable to determine technical equivalency.
4. There were extremely long delays in scheduled deliveries, which resulted in slowdowns, reprogramming, or outright termination of previously planned MWQ and RAMP activities. Examples under the RAMP program include delay and serious compromising of the air quality monitoring and source attribution program, and inability to collect emissions samples from a large number of industries—industries important to the emissions inventory effort and development of emission factors.

These systematic problems occurred throughout EPT, not just in relation to the MWQ and RAMP subprojects. CIP and EPT both had considerable merit and potential to do good. That potential was seriously undermined by the lack of coordination between these two complementary, but administratively separate programs.

ANNEX C: RAMP ORGANIZATIONS

The following organizations also participated in the execution of the RAMP project:

- **USEPA specialists and USEPA's U.S. subcontractors**
  - Radian (early in the project, removed at organizational level in USEPA due to presumed conflict of interest following purchase of Radian by Dow Chemical).
  - Science Applications International Corporation (SAIC) provided technical and engineering support.
  - Eastern Research Group (ERG) [Note: ERG took over implementation from Radian after Radian sold its EPA business unit to ERG because the conflict of interest situation noted above].
  - Institute for Sustainable Communities (ISC) provided public awareness, training, and general administrative support.
  - Eastern Technical Associates (ETA) provided the "smoke generator": for Method 9 training, VE course development in English, training of trainers, and certification of the initial groups of VE observers.

- **Russian subcontractors**
  - Scientific Research Institute – Atmospheric Air Protection (SRI-AAP) and Main Geophysical Observatory (MGO), both of St. Petersburg, provided scientific and regulatory assistance as the key technical resource for the development and certification of sampling and analysis methods at the federal level in Russia.
  - Institute Agroproject (IA) provided local technical support in monitoring programs, pollution audits, and implementation plans for technical components.

- **Local counterparts** at the CET and within the Volgograd City Administration and interested NGOs provided political, technical, and administrative support and—in the case of CET—the vehicle for development and presentation of training programs, public involvement, and community awareness.